



spectrum intelligence systems



RFeye®

Introducing RFeye®

Breakthrough cost and performance for continuous remote real-time spectrum monitoring, intelligence gathering and surveillance

DEFEND CRITICAL BORDERS

RFeye® surveillance of radio signals around sensitive borders, site perimeters and buildings can identify and pinpoint potential security threats.

PROTECT THE PUBLIC

RFeye® in-place monitoring systems can help protect airports, sports stadia and other public arenas against criminal or terrorist activity.

RFeye® BENEFITS

- ◆ Cost-effective standalone systems and remote distributed networks
- ◆ Rugged, lightweight, low power, fully IP rated, designed to operate in hostile environments
- ◆ Low noise figure, high sensitivity and exceptionally low spurious components for reliable detection of even low power signals
- ◆ Product range covers broadband spectrum frequencies from DC to 18 GHz
- ◆ Very fast spectrum sweep rate for high probability of signal intercept
- ◆ Advanced direction finding capability for accurate geo-location of suspicious or unauthorised transmitters
- ◆ High speed real-time access, efficient network communications and data processing using proprietary NCP protocol
- ◆ Flexible deployments in fixed, mobile or man-portable systems, and standard or VITA 46 configuration
- ◆ Powerful RFeye® application and database tools for real-time visualisation of spectrum usage and/or post-event mapping and analysis
- ◆ Open API, fully programmable with C, C# and C++ for running customer applications

TRACK ROGUE TRANSMITTERS

RFeye® can detect and locate rogue transmitters that may represent a nuisance, security threat or cover for criminal activity.

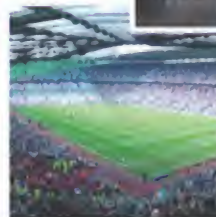
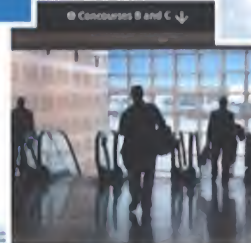
MAXIMISE SPECTRUM EFFICIENCY

RFeye® fixed and mobile systems help regulators better plan and manage spectrum usage, including white space.

SPECTRUM REGULATORS
NETWORK OPERATORS
BROADCASTERS
RF PLANNERS
SPECTRUM MANAGERS



CIVIL
COMMERCIAL
AND
MILITARY AVIATION



PUBLIC SAFETY
AND
EVENT VENUES

DEFENCE FORCES



POLICE
AND
SECURITY SERVICES



Intelligent, cost-effective solution for distributed networks and DF systems

The RFeye is the intelligent engine at the heart of CRFS systems and represents a breakthrough in cost-effective continuous, real time 24/7 monitoring of the radio spectrum.

Capable of sweeping from 10 MHz to 6 GHz in less than 100 ms, and housed in a compact lightweight housing designed for hostile environments and suitable for use in both indoor and outdoor environments, the RFeye may be deployed in both fixed or mobile applications.

The built-in Linux PC permits fully programmable autonomous operation, and high-accuracy GPS provides accurate position and time stamping to allow correlation of data between different RFeyes. Data may be stored locally, transmitted over the air via the built-in GPRS/UMTS modem, or downloaded via standard wired interfaces to a centralised database.

The RFeye also supports direction finding (DF) using both AOA (angle of arrival) and TDOA (time difference of arrival) techniques. The RFeye enables cost-effective deployments of small to very large networks for both civilian and non-civilian applications.

Features

- ◆ Wide frequency range: 10 MHz to 6 GHz (frequency extension to 18 GHz via the RFeye Block Down Converter)
- ◆ Fully modular and scalable from single units to very large networks
- ◆ Rugged, compact, fully weather-proofed
- ◆ Low power, fully IP rated
- ◆ Wide operating temperature range
- ◆ Fast digital sweep for capture of transient signals
- ◆ Excellent sensitivity and low spurious components
- ◆ Flexible frequency tuning
- ◆ Low antenna port LO re-radiation
- ◆ Multiple RF ports for multi-antenna operation
- ◆ Support for AOA and TDOA geo-location
- ◆ High Accuracy GPS or SyncLinc™ synchronisation
- ◆ Secure network connectivity using SSL
- ◆ Flexible remote interfacing and data download, designed for unattended operation
- ◆ Bulk local data storage via USB memory
- ◆ Proprietary NCP system embedded software for efficient data handling and networking
- ◆ Open API, fully programmable with C and C++



Receiver Performance

Frequency range	10 MHz to 6 GHz
Receiver noise figure	8 dB typical (10 MHz - 4 GHz) 11 dB typical (4 GHz - 6 GHz)
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC
3rd order intercept point (IP3)	+20 dBm typical (AGC active)
1 dB input compression	+10 dBm typical (AGC active)
Level accuracy	± 2.5 dB typical
Antenna LO re-radiation	-90 dBm typical
Antenna port isolation	30 dB min. at 2 GHz
SSB phase noise	-90 dBc/Hz at 10 kHz offset -110 dBc/Hz at 200 kHz offset typical, at 2 GHz*
Synthesiser switching time	50 µs typical (fast sweep mode)
Spurious free dynamic range	60 dB min.
AGC range	60 dB

* Low noise synthesiser

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 2 kHz min. (reduced analysis b/w)

Sweep and Triggering

Sweep time	10 MHz - 6 GHz: less than 100 ms*
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: user- definable masks, user-definable action when mask exceeded

* Fast sweep mode

Operating System and Software Development Options

Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

Interfaces

RF input	SMA (X 4)
DC power	10 - 48 VDC
DC power input	Direct to node or via Ethernet
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
GPS antenna	SMA, passive and active (3.3 V nominal DC) antennas supported
UMTS/HSPA modem antenna	SMA
100 Base T Ethernet	1
USB	2
Expansion ports	2, configurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output

Frequency Reference

Selection	Internal, GPS or External
External reference input	Via expansion port, 10 MHz ± 1 kHz
Reference output	Via expansion port, 10 MHz

Internal Frequency Reference

Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±1 ppm (10°C to 30°C)
Ageing	better than ±2 ppm per year

Timing Reference

GPS	35 ns RMS accuracy typical
RFeye SyncLinc	< 10 ns RMS accuracy typical

Mechanical

Dimensions (w h d)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight	1.4 kg (3.1 lb) [Node only] 2.0 kg (4.4 lb) [with environmental protection cover]

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +70°C (-40 to 158 °F)
Environmental protection	IP67 (with environmental cover fitted)

For more information

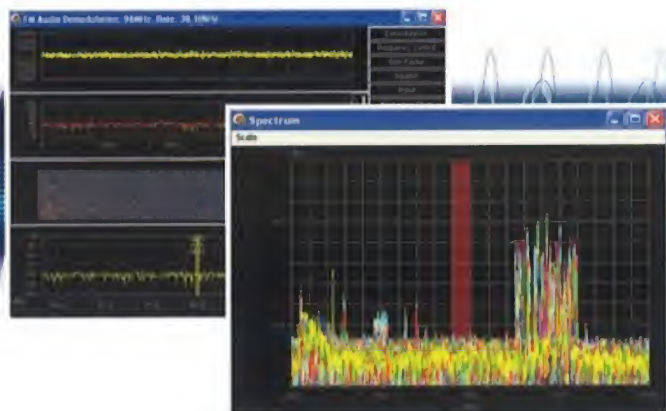


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RFeye Evaluation System



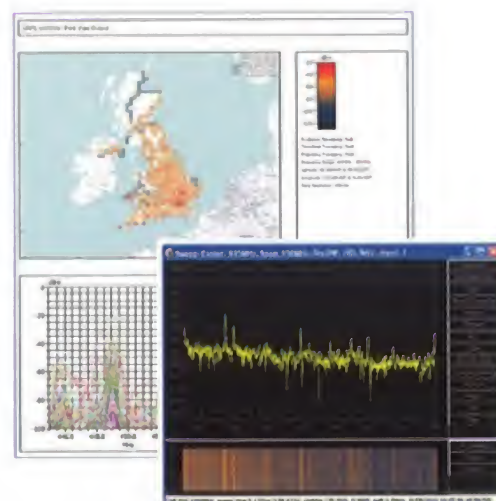
Full kit for broadband evaluation of RFeye technology

The RFeye Evaluation System is an entry-level system designed to allow users to evaluate the capabilities of the RFeye. The system includes an RFeye node, broadband omni-directional measurement antenna, GPS and GPRS/UMTS antennas, power supply and the necessary cables, all contained in a rugged transit case. Also included in the kit is a suite of demonstration level RFeye application software that allows the user to control the unit from a PC and explore the powerful functionality of the RFeye node. This includes a demo-level suite of data visualisation tools and spectrum analyser interface.

The RFeye Evaluation System can also be supplied with a number of software options. These include the RFeye View suite of data visualisation and analysis tools which enable remote data logging and mapping of data from a mobile node across a geographical area; RFeye Live which displays live data from the RFeye either local to the unit or remotely via an IP connection; RFeye DevPack tools which allow software engineers to develop their own applications to run on the node's built-in Linux PC or to control how the node collects and processes data.

Features

- ◆ RFeye node (10 MHz - 6 GHz)
- ◆ Environmental protection cover
- ◆ Broadband omnidirectional antenna inc. mounting hardware
- ◆ GPS and GPRS/UMTS antennas
- ◆ Universal mains power supply
- ◆ RF and screened Ethernet cables
- ◆ Demo software
- ◆ Rugged carry case
- ◆ Memory sticks



TECHNICAL SPECIFICATION

Frequency

Range	10 MHz to 6 GHz
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Sensitivity (equivalent noise figures at maximum sensitivity)

10 MHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Signal Input

Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC

Internal Frequency Reference

Initial accuracy	better than ± 2 ppm at 20°C
Stability	better than ± 1 ppm (10°C to 30°C)
Ageing	better than ± 2 ppm per year

Sweep and Triggering

Sweep time	10 MHz - 6 GHz: less than 100ms*
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed, user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

* Fast sweep mode

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 2 kHz min. (reduced analysis b/w)

Power Supply

DC power	10 - 48 VDC
Power consumption	12 - 18W, radio operational 6 W typical, radio idle

Interfaces

RF input	SMA (X 4)
GPS antenna	SMA
UMTS/HSPA modem antenna	SMA
100 Base T Ethernet	1
USB	2
RFeyeSPI (expansion port)	2

Mechanical

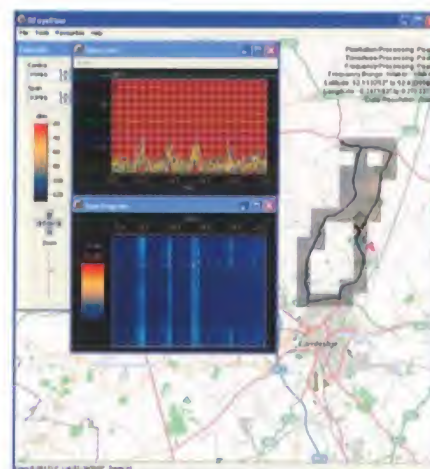
Dimensions (RFeye Node)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight (RFeye Node)	1.4 kg (3.1 lb) [Node only] 2.0 kg (4.4 lb) [with environmental protection cover]
Weight (shipping)	6.7 kg (14.8 lb) [inc. accessories]

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +70°C (-40 to 158 °F)

Accessories

Measurement antenna	Omnidirectional antenna (AOR DA5000, 700 MHz - 5 GHz). Including pole, mounting hardware and 1m (3 ft) cable
GPS antenna	Active type, panel mount inc. cable
GPRS/UMTS antenna	Panel mount, inc. cable
Environmental protection cover	
Universal power supply	90 - 264 V AC, 57 - 63 Hz
DC power lead	2m (6ft)
Logger Control Box	Inc. 1m (3ft) lead
Ethernet cable	2m (6ft), screened
Carry case	External dimensions: 48.7 cm x 38.6 cm x 18.5 cm (19.2 in x 15.2 in x 7.3 in)
USB memory sticks	4GB (x3), inc. demo/application software and documentation



For more information



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RFeye Block Down Converter



Seamless 6 GHz to 18 GHz block down conversion extension for RFeye node

The RFeye Block Down Converter (BDC) extends the frequency range of the RFeye from 6 GHz up to 18 GHz. It takes a wide band of frequencies and converts them into a range that the RFeye node can analyse using the full real-time analysis capabilities of the node.

The BDC is controlled by the RFeye and power is shared with the RFeye via one of its expansion ports. The RF output of the BDC is connected to one of the four antenna inputs on the controlling RFeye node.

The BDC uses the same form factor and mounting options as the RFeye, permitting standardisation of fitment and mounting options, and may be co-sited with the RFeye or mounted remotely.

The BDC is built to the same environmental specifications as the RFeye and is designed for outdoor/indoor, fixed/mobile operation, including in hostile environments.

Features

- ◆ Integrated operation with and seamless frequency extension of the RFeye
- ◆ Extends real-time capability of RFeye from 6 GHz to 18 GHz, including microwave bands
- ◆ Fully modular and scalable from single units to very large networks
- ◆ Rugged, compact, fully weather-proofed
- ◆ Low power, fully IP rated
- ◆ Fast synthesiser tuning and pre selection filtering
- ◆ Custom pre-selection filter options for customer-specific applications
- ◆ Multiple RF ports for multi-antenna operation
- ◆ Support for AOA and TDOA direction finding at extended frequencies
- ◆ Easily fitted to existing RFeye deployments



ARCHITECTURE

Standard RFeye node sweeping 10 MHz to 6 GHz

RFeye Node
10 MHz - 6 GHz

Down Converter
6 GHz - 18 GHz

Block down converter uses same form factor as standard RFeye node and extends RFeye node frequency range to 18 GHz

Down converter can be sited remote or local to RFeye control node

Multiple antenna options supported by the block down converter

Up to 4 x antennas supported by standard RFeye node with the ability to add further antenna switches supporting AOA DF options

Lighting Protection PoE Injector
PoE
48VDC
Ethernet to user equipment

TECHNICAL SPECIFICATION

Frequency

Range	6 GHz to 18 GHz
IF Bandwidth	3 GHz
IF Centre Frequency	2.5 GHz and 3.5 GHz band dependant
Gain	15dB
Phase Noise	-110 dBc/Hz @100kHz typical
Preselection bands * (Standard)	6 - 9 GHz 9 - 12 GHz 12 - 15 GHz 15 - 18 GHz
* Custom bands	Option to fit custom filters to add extra out of band rejection in specific bands

Interfaces

RF input	2 switchable inputs (SMA)
DC power from external source	10 - 48 VDC
Power consumption	10 W typical
Reference clock input	10 MHz from RFeye Node

Sensitivity (equivalent noise figures at maximum sensitivity)

6 GHz - 15 GHz	9 dB typical
15 GHz - 18 GHz	10 dB typical

Signal Input

Input connector	Two switchable SMA inputs
Maximum input level	+15 dBm; 15 VDC

Signal Output

Output connector	Single SMA output
Maximum output level	-20 dBm

Mechanical

Dimensions (w h d)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight	2.0 kg (4.4 lb) [with environmental protection cover]

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +70°C (-40 to 158 °F)

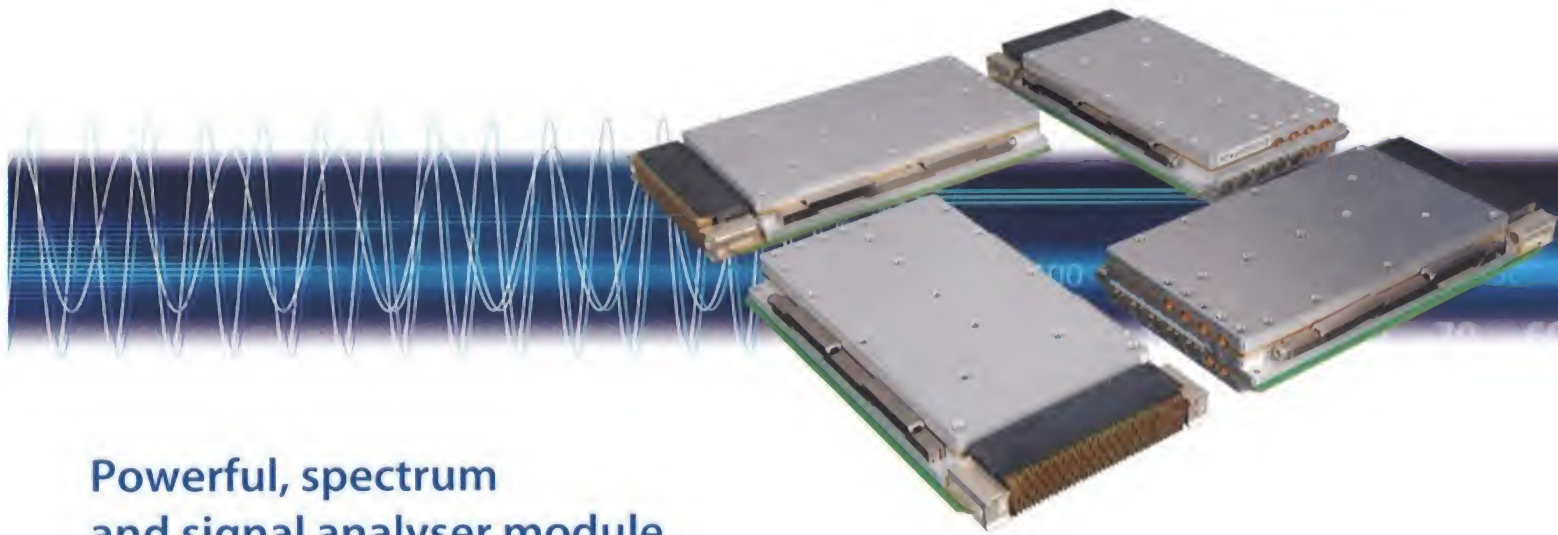
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Powerful, spectrum and signal analyser module for high-end applications

Capable of sweeping from 10 MHz to 6 GHz in less than 100 ms, the RFeye VITA module is designed for easy integration with other VPX/VITA 46 system elements and can also be configured as a stand-alone, intelligent spectrum/signal acquisition system.

Multiple RF inputs support direction finding (DF) using AOA (angle of arrival) techniques or allow comparison of signals from different antennas in SIGINT applications.

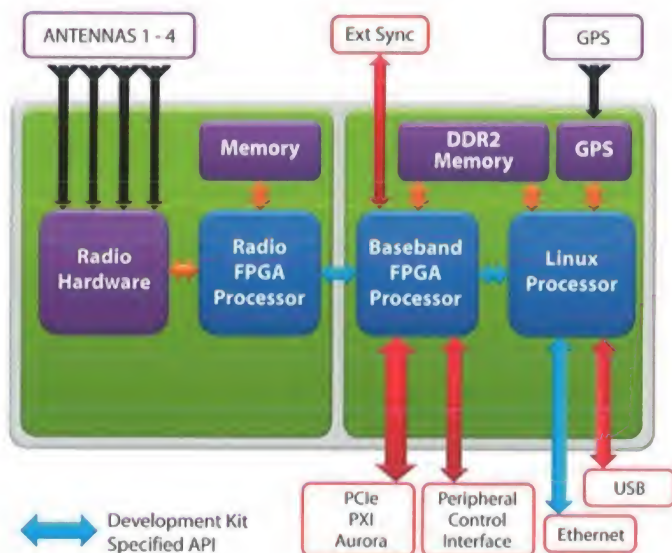
The built-in Linux PC permits fully programmable autonomous operation, and timing and synchronisation features allow correlation of data between multiple RFeye VITA modules when required, for instance when TDOA (Time Difference of Arrival) is being used to identify signal location.

A flexible backplane interface allows the module to be configured to support multiple data transfer protocols, including emulation of legacy equipment where necessary.

Features

- ◆ Wide frequency range: 10 MHz to 6 GHz
- ◆ Rugged, lightweight, compact, low power
- ◆ 3U rack-mountable
- ◆ Support for AOA and TDOA geo-location
- ◆ Multiple RF ports for multi-antenna operation
- ◆ Fast digital sweep for capture of transient signals
- ◆ Flexible real-time signal acquisition and data processing
- ◆ Flexible remote interfacing via high-bandwidth backplane connectivity
- ◆ Built-in Linux PC supports user-programmable scan sequences and selective data acquisition
- ◆ Proprietary NCP system embedded software for efficient data handling and networking
- ◆ Open API, fully programmable with C and C++

ARCHITECTURE



RACK MOUNTABLE MODULES



TECHNICAL SPECIFICATION

Frequency

Range	DC to 6 GHz
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Internal Frequency Reference

Initial accuracy	better than ± 2 ppm at 20°C
Stability	better than ± 1 ppm (10°C to 30°C)
Ageing	better than ± 2 ppm per year

Sweep and Triggering

Sweep time	DC to 6 GHz: less than 100ms*
Sweep mode	Fully programmable: Free run, continuous, single, timed
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 2 kHz min. (reduced analysis b/w)

Software Development Options

Linux OS version (with Opt 01)	2.6
Development environments	Full SDK C and Python development environment available

* Fast sweep mode

Sensitivity (equivalent noise figures at maximum sensitivity)

10 MHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Signal Input

Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC

Interfaces

RF input	4 switchable inputs
DC power	10 - 24 VDC
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
Trigger input	1 pps
Reference clock input	10 MHz, 0.5 V rms
Ethernet (with Opt 01)	100 Base T
USB (with Opt 01)	1

Mechanical

Dimensions (w h d)	170 mm x 100 mm x 24.5 mm (6.7 in x 3.9 in x 0.96 in)
Weight	600 g (1.3 lb)

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +70°C (-40 to 158 °F)

For more information



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Single- or multi-channel DF systems for accurate target geo-location

RFeye DF is a flexible, cost-effective platform for remote broadband spectrum monitoring and geo-location of target transmitters of all types. Systems can be configured using a single RFeye node or multi-channel with the addition of further nodes. They are fully modular and single-channel systems can be upgraded to multi-channel for higher probability of signal intercept.

RFeye nodes are co-located with their antenna arrays and, for multi-channel systems, with each other. This tight coupling reduces cable runs and cable losses and significantly improves performance. Systems are compact and can be deployed in a vehicle roof box, on a mast or roof top. Multiple RFeye DF systems can be installed on a site, perimeter or border to detect and geo-locate the sources of suspicious signals.

Various DF techniques can be employed. The RFeye nodes may be individually synchronised to a GPS timing reference or over a network connection using SyncLinc™ connector modules. Once synchronised, all nodes sweep simultaneously for precise geo-location based on time difference of arrival (TDOA) or relative power on arrival (POA) at each receiver point, as well as sensing the angle of arrival (AOA) based on signal amplitude. Each technique can be used individually or all three can be overlaid for high probability geo-location.

Features

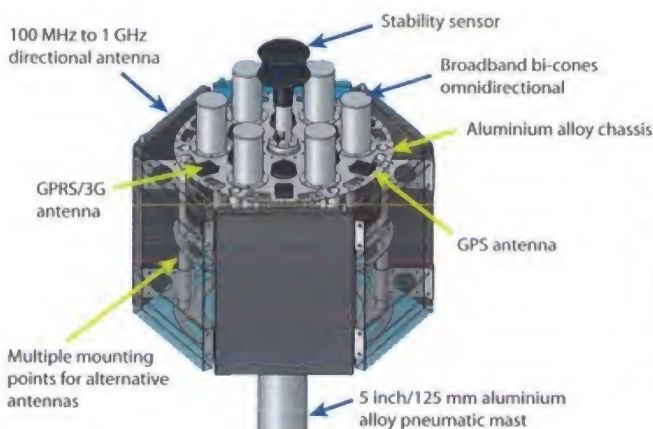
- ◆ Cost effective monitoring and geo-location from 10 MHz to 6 GHz
- ◆ Extendable to 18 GHz with RFeye Block Down Converter
- ◆ Mast mountable for border and site monitoring
- ◆ Low power, ruggedised and transportable
- ◆ Single or multi-channel monitoring using real-time receivers
- ◆ Simultaneous multi-channel AOA, TDOA and POA overlay
- ◆ Fully synchronised sweeps using SyncLinc™ or GPS
- ◆ Remote standalone operation or as part of a real time network
- ◆ Easily integrated into legacy and third party systems using NCP
- ◆ Fully programmable sector and alarm warning systems
- ◆ Ethernet and cellular connectivity



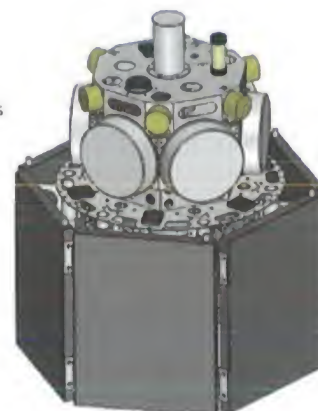
SINGLE-CHANNEL SYSTEM



MULTI-CHANNEL SYSTEM



COMBINED SYSTEM



TECHNICAL SPECIFICATION

Frequency Range

RFeye node	10 MHz to 6 GHz
RFeye Block Down Converter	6 GHz to 18 GHz

Internal Frequency Reference

Timing reference with GPS	GPS 10 MHz reference
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Sweep and Triggering

Sweep time	10 MHz - 6 GHz: less than 100ms*
Sweep mode	Fully programmable
Trigger on event	Fully programmable

* Fast sweep mode

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 2 kHz min. (reduced analysis b/w)

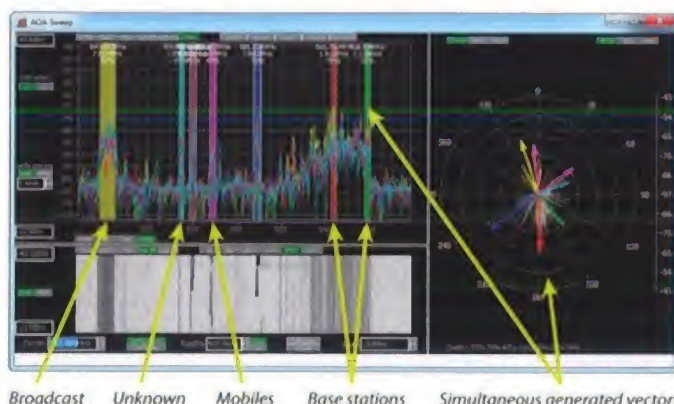
Operating System and Software Development Options

Linux OS version	2.6
Python version	2.6

Interfaces

DC power	10 - 48 VDC
GPRS/HSPA modem	PPP and SMS connection protocols
100 Base T Ethernet	1
External 10 MHz Reference	1
GPS Reference	Built in

MULTIPLE TARGET AOA PROCESSING



Sensitivity (equivalent noise figures at maximum sensitivity)

10 MHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

RF

Radio input connectors	4 antenna inputs per node
Maximum input level	+15 dBm

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +70°C (-40 to 158 °F)

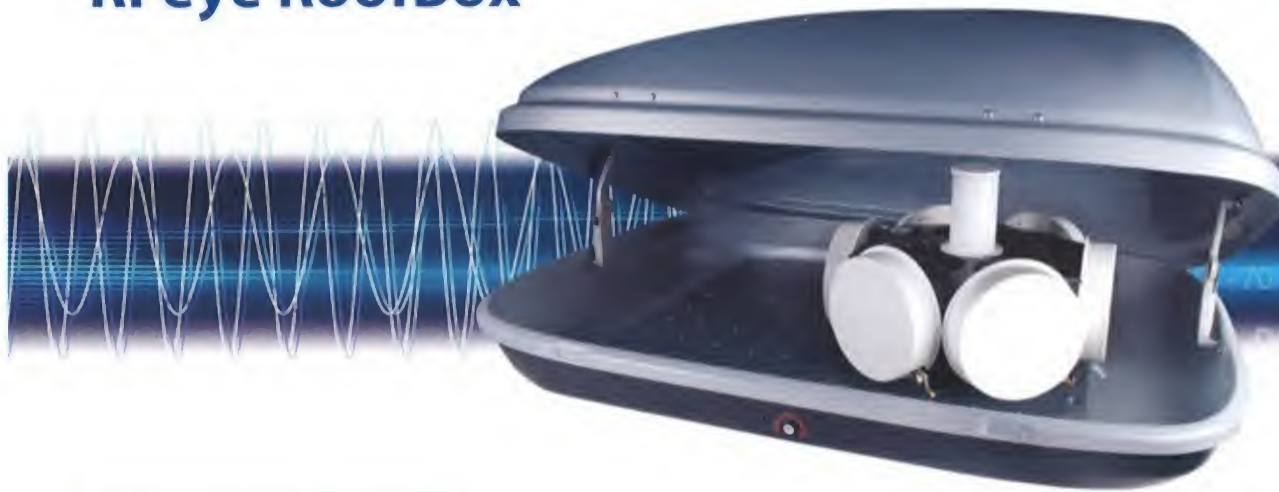
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Integrated system for automated vehicle-based spectrum surveillance

The RFeye RoofBox is a complete pre-integrated vehicle-mounted solution designed to allow discreet spectrum surveillance over wide areas. It comes configured with a choice of internally mounted broadband omnidirectional antenna or DF antenna array for AOA (angle of arrival) direction finding. The system is built into a standard commercial roof box and includes an RFeye node, antennas, power controller and back-up battery, and high-capacity USB memory stick for local storage.

The RFeye node may be pre-programmed with the required measurement profile (frequency range(s), measurement interval(s), resolution bandwidth(s), statistical processing required, etc.) prior to the start of the survey. This allows deployment by non-technical personnel where required. The built-in high accuracy GPS receiver is used to tag the data received to map data against location. Data is normally logged to a USB memory stick for easy transfer of data after each survey, or may also be transmitted over the built-in GPRS/HSPA modem.

The powerful Linux PC built into the RFeye allows for conditional data acquisition (inc. if-then-else constructs) and statistical analysis as the data is collected to maximise the usefulness of the survey. In addition, a netbook PC may be connected for monitoring signals in real time during the survey.

Features

- ◆ Wide frequency range: 10 MHz to 6 GHz (or 18 GHz using RFeye Block Down Converter)
- ◆ Complete self-contained system for mobile spectrum surveys
- ◆ Fully ruggedised integrated solution
- ◆ Single (power) connection to vehicle
- ◆ Support for AOA and TDOA geo-location
- ◆ Designed for use by unskilled personnel, if required
- ◆ Optional connection to local PC for live monitoring



THREE EASY STEPS TO DISCREET SPECTRUM SURVEILLANCE:

1) Define acquisition scenario

```
[config]
# Define maximum file size in bytes for data files
max_files_size = 10000000

# Define unit or campaign information
unit_info = "Town Survey 050709"

# Describe the scans the unit will perform and onboard data processing required

[scan1]
# First scan: 800-2000 MHz, 0.1 sec between scans, narrow RBW
scan = 0.1,1,800,2000,1024,8
#
# Define statistics to be collected for scan1
peak = 11,4,-1,"Peak capture for scan1"
mean = 12,4,-1,"Mean capture for scan1"
cpeak = 13,1,-1,"Compressed peak", -110
occl = 16,1,-1,"Occupancy -100 threshold 5 mins",300,-115,8

[scan2]
# Second scan: 100-5000 MHz, 5 sec between scans, wider RBW
scan = 5,0,1,100,5000,256,16
#
# Define statistics to be collected for scan2
cpeak=17,3,-1,"Compressed peak from 100 MHz to 5 GHz",100
```

2) Perform survey



3) Analyse data (RFeye View, RFeye DAS)



TECHNICAL SPECIFICATION

Frequency

RFeye node	10 MHz to 6 GHz
RFeye Block Down Converter	6 GHz to 18 GHz

Signal Input

Maximum input level	+15 dBm; 15 VDC
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Internal Frequency Reference

Initial accuracy	better than ± 2 ppm at 20°C
Stability	better than ± 1 ppm (10°C to 30°C)
Ageing	better than ± 2 ppm per year

Sweep and Triggering

Sweep time	10 MHz - 6 GHz: less than 100ms*
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed, user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 2 kHz min. (reduced analysis b/w)

Operating System and Software Development Options

Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

* Fast sweep mode

Antennas

Measurement (Omnidirectional)	700 MHz - 6 GHz (usable to 100 MHz)
Measurement (Directional - DF array)	6 x 600 MHz - 6 GHz (Circular polarisation)
Measurement (Other)	Other antennas may be accommodated Please contact CRFS for further details
GPS	Built-in
GPRS/HSPA	Built-in

Sensitivity (equivalent noise figures at maximum sensitivity)

10 MHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Interfaces

100 Base T Ethernet	For external monitoring
USB	2, for memory sticks (system programming and/or bulk result storage)

Power Supplies

Ext DC input	10 V DC - 36 V DC
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle

Mechanical

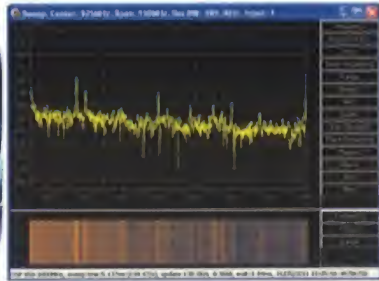
Roof box	Thule Karrite PB310 or equivalent
Dimensions (w d h)	130 cm x 85 cm x 39 cm (51.2 in x 33.5 in x 15.4 in)
Weight	21.0 kg (46.2 lb)

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +55°C (-40 to 131 °F)

For more information

RFeye StormCase



Ruggedised spectrum intelligence system for field deployment

The RFeye StormCase is a complete man-portable system containing a ready deployed and ruggedised RFeye embedded in a sturdy Peli StormCase IM2400. The system is fully configured and ready to go "out of the box". It contains a built-in 12 VDC dry lead-acid battery that is suitable for extreme temperature range operation (and is approved as carry on for commercial flights) giving up to 6 hours continuous battery operation. A versatile power control system allows multiple power source inputs from 10 VDC to 36 VDC as well as mains operation for fast charge and prolonged fixed site operation. 48 VDC Power On Ethernet connection is also present. All ports for antennas, GPS, UMTS modem, WiFi, Ethernet and USB are exposed to offer maximum flexibility for logging and analysing spectrum without the need for a laptop. High capacity memory sticks or disk drives can be connected to the USB ports. The RFeye StormCase can operate stand alone without PC as the RFeye uses a Linux operating system running the latest analysis and logging tools from CRFS. Multiple units can be networked and time synchronised to perform real time scanning and geo location operations from 10 MHz to 6 GHz either in-building or over wide geographic areas.

The RFeye StormCase is supplied with GPS and UMTS antennas, rapid charging system, mains power supply, vehicle power supply connector and spectrum data logger.

Features

- ◆ Rugged field deployable StormCase system
- ◆ IP67 rated for -30°C to +55°C operation
- ◆ Rechargeable 6 hour battery life
- ◆ Connectivity for multiple external power options
- ◆ UMTS modem for 2G and 3G cellular connectivity
- ◆ Built in GPS for high accuracy time stamping of data
- ◆ Multiple antenna options via internal and external connections
- ◆ DF array connectivity from front panel
- ◆ Standalone operation or as part of a network
- ◆ Designed for use by skilled or unskilled personnel
- ◆ TDOA and AOA geo-location options available
- ◆ Optional connection to local PC for live monitoring with RFeye Live
- ◆ Optional post-survey data mapping with RFeye View



spectrum intelligence systems

THREE EASY STEPS TO DISCREET SPECTRUM SURVEILLANCE:

1) Define acquisition scenario

```
[config]
# Define maximum file size in bytes for data files
max_files_size = 10000000

# Define unit or campaign information:
unit_info = "Town Survey 050709"

# Describe the scans the unit will perform and onboard data processing required:

[scan1]
# First scan: 800-2000 MHz, 0.1 sec between scans, narrow RBW
scan = 0.1,1,800,2000,1024,8
#
# Define statistics to be collected for scan1:
peak = 11,4,-1,"Peak capture for scan1"
mean = 12,4,-1,"Mean capture for scan1"
cpeak = 13,1,-1,"Compressed peak",-110
occl = 16,1,-1,"Occupancy -100 threshold 5 mins",300,-115,8

[scan2]
# Second scan: 100-5000 MHz, 5 sec between scans, wider RBW
scan = 5.0,1,100,5000,256,16
#
# Define statistics to be collected for scan2:
cpeak=17,1,-1,"Compressed peak from 100 MHz to 5 GHz",100
```

2) Perform survey



3) Analyse data (RFeye View, RFeye DAS)



TECHNICAL SPECIFICATION

Frequency

Range	10 MHz to 6 GHz
-------	-----------------

Signal Input

Maximum input level	+15 dBm; 15 VDC
---------------------	-----------------

Internal Frequency Reference

Initial accuracy	better than ± 2 ppm at 20°C
Stability	better than ± 1 ppm (10°C to 30°C)
Ageing	better than ± 2 ppm per year

Sweep and Triggering

Sweep time	10 MHz - 6 GHz: less than 100ms*
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed, user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 2 kHz min. (reduced analysis b/w)

Operating System and Software Development Options

Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

* Fast sweep mode

Antennas

Measurement	3 internal and 1 external connections provided
GPS	Internal/external connections provided
GPRS/UMTS	Internal connection provided and antennas supplied

Sensitivity (equivalent noise figures at maximum sensitivity)

10 MHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Interfaces

DC power	For external DC supply
100 Base T Ethernet	For external monitoring
USB	2, for memory sticks (system programming and/or bulk result storage)

Power Supplies

Battery	Dry Cell MIL S-901C (non-spillable) 6 hour nominal capacity
Charger	Universal, 100 - 240 VAC
Charge time	6 hrs (typical)
Ext DC input	10 - 36 VDC, 48VDC POnE
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle

Mechanical

External dimensions (w d h)	48.7 cm x 38.6 cm x 18.5 cm (19.2 in x 15.2 in x 7.3 in)
Weight	13.7 kg (30 lb)

Environmental

Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +55°C (-40 to 131 °F)

For more information



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RFeye BackPack



Compact, lightweight system for discreet spectrum surveys

The RFeye BackPack is a complete integrated man-portable solution designed to allow discreet spectrum surveillance in urban or security-critical environments.

Built into a standard commercial backpack, the system includes an RFeye, environmental protection cover, internally-mounted antennas, battery providing approximately 6 hours of useful life, power controller and charger, and high-capacity USB memory stick for local storage. Overall weight is approximately 6 kg (13.2 lb).

The system may be pre-programmed with the required measurement profile – frequency range(s), measurement interval(s), resolution bandwidth(s), statistical processing required, etc. – prior to the start of the survey. This allows deployment by non-technical personnel where required. The built-in high accuracy GPS receiver is used to tag the data received to allow mapping against location. In locations with poor GPS coverage, 'waypoint' based location logging may alternatively be used. Data is logged to a USB memory stick for easy transfer of data after each survey.

The powerful Linux PC built into the RFeye node allows for conditional data acquisition (including if-then-else constructs) and statistical analysis as the data is collected to maximise the usefulness of the survey. In addition, a netbook PC may be connected for monitoring signals in real time during the survey.

Features

- ◆ Complete self-contained backpack system for discreet local spectrum surveys
- ◆ Integrated lightweight portable solution (6 kg / 13.2 lb)
- ◆ Long battery life (typically 6 hours)
- ◆ Includes power controller/charger and mains/car power adaptors
- ◆ GPS and GPRS/HSPA antennas
- ◆ Designed for use by unskilled personnel, if required
- ◆ Optional connection to local PC for live monitoring



THREE EASY STEPS TO DISCREET SPECTRUM SURVEILLANCE:

1) Define acquisition scenario

```
[config]
# Define maximum file size in bytes for data files:
max_file_size = 10000000

# Define unit or campaign information
unit_info = "Town Survey 050709"

# Describe the scans the unit will perform and onboard data processing required:

[scan1]
# First scan: 800-2000 MHz, 0.1 sec between scans, narrow RBW
scan = 0 1,1,800,2000,1024,8
#
# Define statistics to be collected for scan1:
peak = 11,4,1,"Peak capture for scan1"
mean = 12,4,1,"Mean capture for scan1"
cpeak = 13,1,1,"Compressed peak", -110
occ1 = 16,1,1,"Occupancy -100 threshold 5 mins",300,-115,8

[scan2]
# Second scan: 100-5000 MHz, 5 sec between scans, wider RBW
scan = 5 0,1,100,5000,256,16
#
# Define statistics to be collected for scan2:
cpeak=17,1,1,"Compressed peak from 100 MHz to 5 GHz",100
```

2) Perform survey



3) Analyse data (RFeye View, RFeye DAS)



TECHNICAL SPECIFICATION

Frequency

Range	10 MHz to 6 GHz
-------	-----------------

Signal Input

Maximum input level	+15 dBm; 15 VDC
---------------------	-----------------

Internal Frequency Reference

Initial accuracy	better than ± 2 ppm at 20°C
Stability	better than ± 1 ppm (10°C to 30°C)
Ageing	better than ± 2 ppm per year

Sweep and Triggering

Sweep time	10 MHz - 6 GHz: less than 100ms*
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed, user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis

Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w)
	2 kHz min. (reduced analysis b/w)

Operating System and Software Development Options

Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

* Fast sweep mode

Antennas

Measurement	Connection provided for external antenna or internal stub antenna
GPS	Built-in
GPRS/HSPA	Built-in

Interfaces

DC power	For external DC supply
100 Base T Ethernet	For external monitoring
USB	2, for memory sticks (system programming and/or bulk result storage)

Power Supplies

Battery	Dry cell AGM type (non-spillable), 5 hour nominal capacity
Charger	Universal, 100 - 240 VAC
Charge time	6 hrs (typical)
Ext DC input	10 - 48 VDC
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle

Mechanical

Dimensions (w d h)	35 cm x 21.5 cm x 44.5 cm (13.8 in x 8.5 in x 17.5 in)
Weight	6.0 kg (13.2 lb)

Environmental

Operating temperature	-30 to +30°C (-22 to 86 °F)
Storage temperature	-40 to +55°C (-40 to 131 °F)

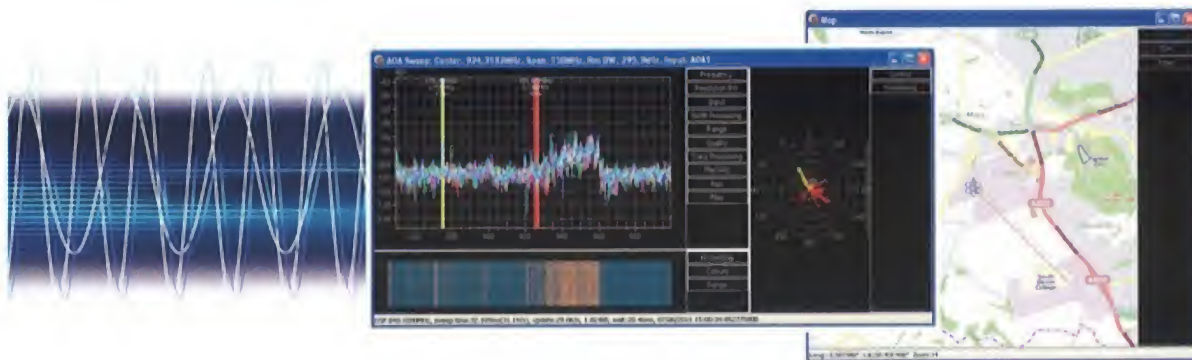
For more information



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Powerful spectrum analyser interface for real-time interaction with the RFeye node

RFeye Live is a standalone application that provides a state-of-the-art spectrum analyser interface. Using RFeye Live you can display live spectral data from the node either local to the unit or remotely via an IP link and can record data for subsequent playback and analysis.

All traditional spectrum monitoring functions are provided plus a number of additional functions specific to the RFeye, such as simultaneous display of signals from up to 4 RF inputs, dynamic AGC attenuation level and control of signal processing to be performed by the node.

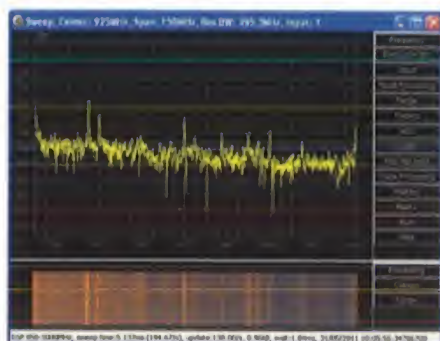
In conjunction with the RFeye node, RFeye Live displays sweep and time data and performs audio demodulation from 10 MHz to 6 GHz. This dynamic range can be extended to 18 GHz with use of the RFeye Block Down Converter. RFeye Live also supports AOA functionality where a DF antenna array is used together with an RFeye 6 GHz or 18 GHz switch.

RFeye Live enables multiple instances to be run on the same computer, allowing connections for multiple RFeye nodes, as well as multiple connections to individual nodes from either a single computer or multiple computers.

RFeye Live is an invaluable tool for live investigation of the RF environment both in the laboratory and in the field.

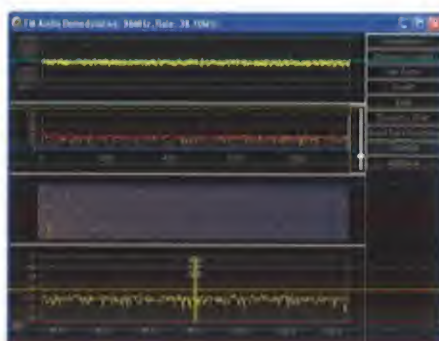
Features

- ◆ Intuitive interface with mouse control
- ◆ Interactive local or remote control over IP network
- ◆ Fast display update
- ◆ Simultaneous multiple RF input display
- ◆ Marker and region functions
- ◆ Flexible trigger and mask functions
- ◆ Signal processing functions including averaging, peak hold
- ◆ Data logging functions
- ◆ Display of measured power or field strength
- ◆ Geo-location including AOA capability
- ◆ Data map overlay
- ◆ Mouse control for multiple functions including scrollable scan widths
- ◆ Powerful signal classification plug-in option



SWEEP

The sweep screen displays a simple sweep with controls to start/stop frequencies and select resolution bandwidth. Multiple analysis options including peak hold, multiple markers, masks, data recording and playback.



AUDIO

The audio screen allows the user to tune into a particular frequency and output the demodulated FM or AM signal.



MAP

The map screen displays the current location of the RFeye node as determined from the on-board GPS receiver. It also connects with the AOA screen and overlays angle of arrival data.



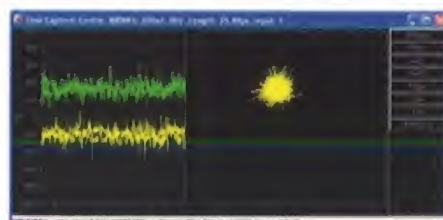
AOA

The angle of arrival screen displays angle of arrival of target signals of interest. Multiple sources can be analysed simultaneously and various functions applied to improve accuracy of angle.



MONITOR

The monitor screen shows the current temperatures, voltages and currents recorded by the RFeye node.



TIME

The time screen displays a simple time capture sweep with controls to set centre frequency, number of samples to capture and trigger mechanisms, plus options to save captured data to file.

TECHNICAL SPECIFICATION

Displays

Spectrum	Traditional spectrum display with markers and trace functions
Waterfall	Cascading colour coded spectrum display
Status	Network node property tree showing node properties and allowing node configuration

PC Requirements

Operating System	Windows XP, 2000, Vista, Windows 7
Hard Disk Space	10 MB
Memory	1 GB recommended

File Export

Data File	NCP (CRFS format)
Audio	WAV format

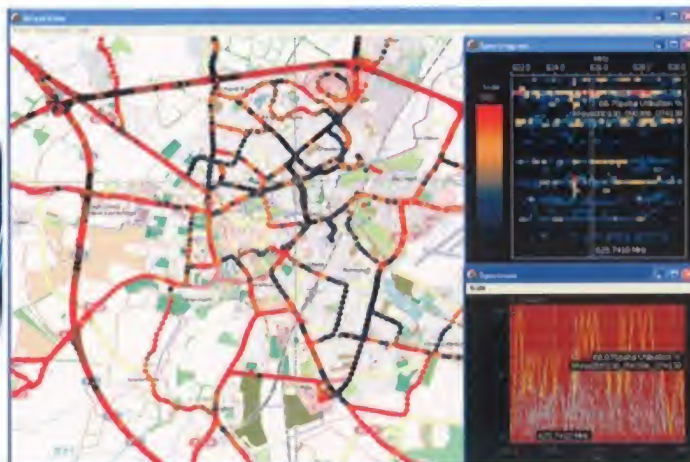
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Powerful mapping, visualisation and analysis tool for RFeye spectrum surveys

RFeye View is a powerful software package with user friendly interface for quick and easy visualisation and analysis of captured data from spectrum surveys using RFeye. Data may be analysed at any desired geographic resolution, from world or national level down to individual measurement positions at street level. Data captured from either fixed or mobile monitoring networks can be quickly and accurately displayed and analysed using a variety of tools. For example, the map view provides an overview of the data in a geographic area, whilst the spectrum and spectrogram views give alternative viewpoints on the same data. Selecting data on any one of the display windows automatically highlights the same data in the other windows. Spectrum usage may be analysed for specific combinations of monitoring nodes or networks, for frequency ranges of interest and signal characteristics (e.g. peak or average signal strength, or occupancy).

RFeye View is designed to run as a stand-alone application with no installation of the software required. Flexible licensing allows the application to be locked to a specific machine or a specific USB drive to allow usage on different hosts. Mapping is provided by OpenStreetMap.org and requires an internet connection.

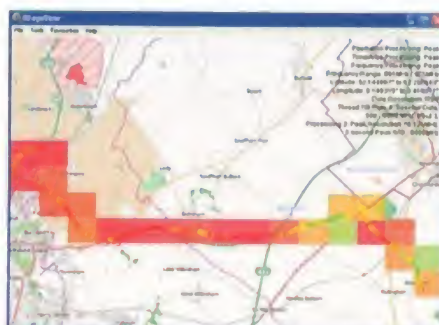
Features

- ◆ Interactive analysis of large data sets (up to 2 GB)
- ◆ Mapping of data from fixed or mobile RFeye nodes
- ◆ Multiple data windows with synchronised display and highlighting
- ◆ World-level to street-level display resolution
- ◆ Interactive zoom between geographical resolutions
- ◆ Geographic points of interest overlays
- ◆ Extensive data filtering options
- ◆ Signal levels displayed as power or field strength
- ◆ Display of peak and mean signal levels and band utilisation
- ◆ Built-in report generating tool
- ◆ Stand-alone PC application



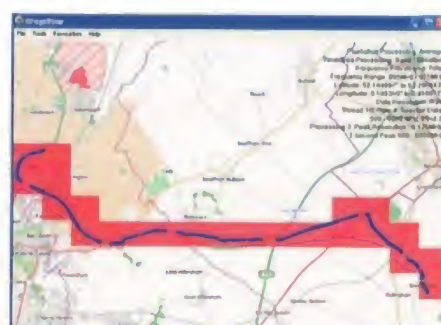
MEAN SIGNAL

The mean signal screen displays the average signal strength of all measurements taken in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



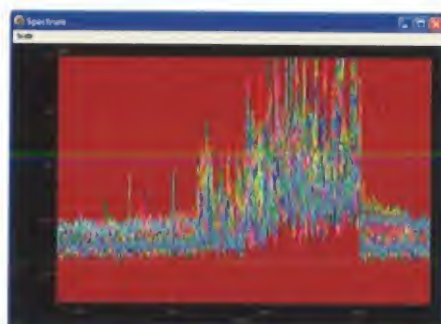
PEAK SIGNAL

The peak signal screen displays the highest data point measurement of signal strength in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



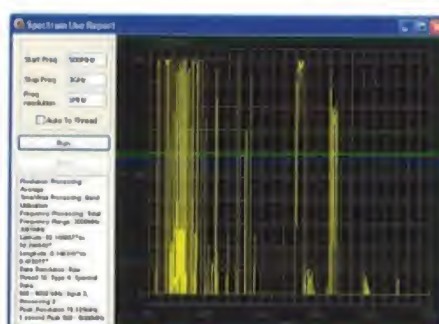
BAND UTILISATION

The band utilisation screen displays the amount of signal measured in a given geographic area for a given frequency band and expresses this as a percentage utilisation. The parameters of the geographic area and frequency band can be selected.



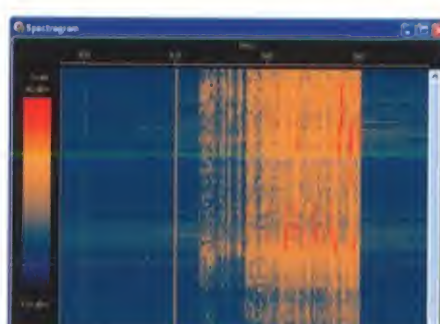
SPECTRUM

The spectrum screen displays signal strength against frequency for a given geographic area and frequency band. The parameters of the geographic area and frequency band can be selected.



SPECTRUM USE REPORT

The spectrum use report screen displays percentage utilisation of a given frequency band in a given geographic area. The parameters of the geographic area and frequency band can be selected.



SPECTROGRAM

The spectrogram screen displays spectrum usage over time as measured by a mobile RFeye as it travels through an area. The spectrogram shows temporal characteristics of signals and allows the user to map a specific event to a geographic location at a point in time.

TECHNICAL SPECIFICATION

Display Processing Options

Spatial	Peak, Average, Band Utilisation
Frequency	Peak, Average, Total
Pixellation	Peak, Average signal level
Filtering	Frequency, Time and Date, Area, RFeye Node

PC Requirement

Operating System	Windows XP, 2000, Vista, Windows 7
Hard Disk Space	4 GB (Map Cache) + File Storage
RAM	3 GB (recommended)

Displays

Map	Whole world to street level
Spectrum and Spectrogram	All frequencies to individual bin
Report	All frequencies to individual bin
Overlay	Any KML Format File

For more information



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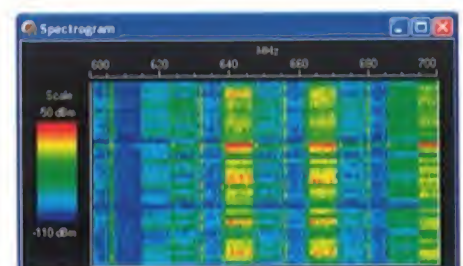
Enterprise level spectrum mapping and analysis database tool for very large data sets

RFeye DAS is an enterprise level database application for the management, analysis and visualisation of the very large data sets collected by modern spectrum monitoring organisations. Using a proprietary database architecture and data processing tools designed specifically for this purpose, RFeye DAS provides fast, fully interactive analysis and visualisation of spectrum usage from both mobile and fixed monitoring networks.

RFeye DAS concentrates raw spectral data files into a smaller number of large files for ease of access and management. Parameters for individual data records are automatically stored in a relational database to allow efficient searching and querying. The raw data is processed to form a number of aggregations over different spatial and time scales, and the processed data is stored in the database together with associated geo-location and time data. RFeye DAS is able to access the raw and processed data, together with the relational database, to display and analyse spectral data in a number of different ways, including synchronised map-based displays, spectrum plots and spectrograms, occupancy plots, and time evolutions. Data can be selected by any combination of RFeye node/network, location, time window or frequency range, and resolution can be displayed from national level to individual street location. Many different reports can be produced and tailored to specific requirements.

Features

- ◆ Designed for very large data sets (multi-terabyte)
- ◆ Powerful, interactive data analysis and visualisation
- ◆ Multiple, synchronised data display windows
- ◆ Display of signal levels, peak, mean signal power and band utilisation
- ◆ Interactive zoom between geographical resolutions
- ◆ Geographic points of interest overlays
- ◆ Extensive data filtering options
- ◆ Data validation and cleansing
- ◆ Statistical analysis
- ◆ User-definable reports
- ◆ Export of data and results in user-selectable formats
- ◆ Built-in report generating tool
- ◆ Import and conversion of legacy/historical data (option)





MEAN SIGNAL

The mean signal screen displays the average signal strength of all measurements taken in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



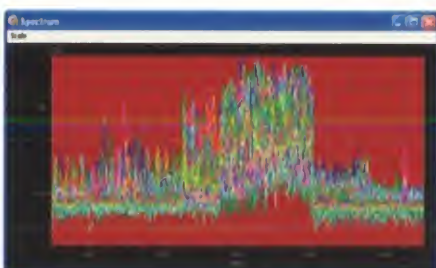
PEAK SIGNAL

The peak signal screen displays the highest data point measurement of signal strength in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



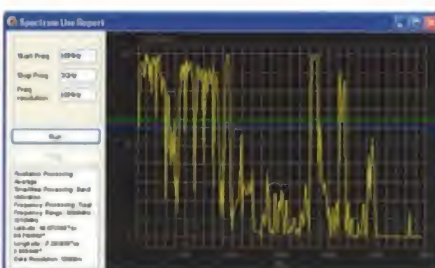
BAND UTILISATION

The band utilisation screen displays the amount of signal measured in a given geographic area for a given frequency band and expresses this as a percentage utilisation. The parameters of the geographic area and frequency band can be selected.



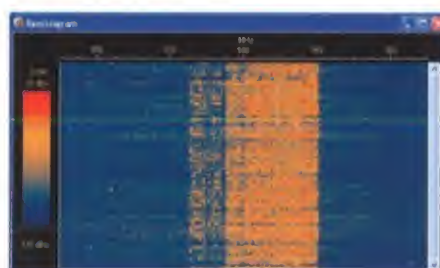
SPECTRUM

The spectrum screen displays signal strength against frequency for a given geographic area and frequency band. The parameters of the geographic area and frequency band can be selected.



SPECTRUM USE REPORT

The spectrum use report screen displays percentage utilisation of a given frequency band in a given geographic area. The parameters of the geographic area and frequency band can be selected.



SPECTROGRAM

The spectrogram screen displays spectrum usage over time as measured by a mobile RFeye as it travels through an area. The spectrogram shows temporal characteristics of signals and allows the user to map a specific event to a geographic location at a point in time.

TECHNICAL SPECIFICATION

Display Processing Options

Spatial	Peak, Average, Band Utilisation
Frequency	Peak, Average, Total
Pixellation	Peak, Average signal level
Filtering	Frequency, Time and Date, Area, RFeye Node

Database Platform

RDBMS	PostgreSQL
-------	------------

PC Requirement

Operating System	Windows XP, 2000, Vista, Windows 7
Hard Disk Space	4 GB (Map Cache) + File Storage
RAM	3 GB (recommended)

Displays

Map	Whole world to street level
Spectrum and Spectrogram	All frequencies to individual bin
Report	All frequencies to individual bin
Overlay	Any KML Format File

For more information



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